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Contract No. NOa(s)-10259

AN/AAR-4 and AN/AAR-5

INFRARED EQUIPMENT

REPORT NO. 01-47

February 1953

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Contractor
RADIO CORPORATION OF AMERICA
Camden 2, New Jersey

BUREAU OF AERONAUTICS

ELECTRONICS DIVISION
SECTION EL-433

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COMPLETION DATES

1. Estimated date of completion of project. 30 June 1954
2. Estimated date of completion of first
AN/AAR-4 (See Note #1)
3. Estimated date of completion of third
AN/AAR-4 15 April 1953
4. Estimated date of completion of eight
AN/AAR-4 15 June 1953
5. Estimated date of completion of first
AN/AAR-5 30 April 1953
6. Estimated date of completion of third
AN/AAR-5 15 June 1953
7. Estimated date of completion of eight
AN/AAR-5 1 September 1953
8. Estimated date of completion of quartz
experimental irdomes (See Note #2)
9. Estimated date of completion of plastic
experimental irdomes (See Note #2)
10. Estimated date of completion of test
equipments. 30 September 1953

Note #1 First equipment is currently undergoing type tests before delivery.

Note #2 Development of irdomes will be subcontracted. Completion dates will be defined after receipt of delivery promises from the subcontractor.

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SECTION A - PURPOSE:

1. The purpose of this contract is the development of two types of airborne infrared receiving sets and the design and construction of models of each type for evaluation by the Navy.
2. The AN/AAR-4 is a tail-warning device. Its purpose is to detect and furnish directional information of pursuing aircraft in sufficient time for the pilot to take evasive action. The AN/AAR-5 is an intercept device. It permits forward search and tracking of reciprocating or jet engine aircraft at relatively long ranges. The detailed requirements for each type are covered by Bureau of Aeronautics Specifications XEL-72 and XEL-87, respectively.
3. The work was originally scheduled to be divided into two phases. Phase I included the exploration, studies, and investigations required by the specifications or deemed essential by the contractor prior to the construction of the equipment. Phase II covered the design, construction, and test of the models to be delivered.
4. As the work progressed, it became obvious that the scope of Phase I had to be broadened to include the construction of bench model "breadboards" of each equipment, based on preliminary design recommendations approved by the Bureau. This step was considered necessary because of the complexity of the mechanisms and electronic circuits. It has provided the contractor and the Bureau with an indication of the performance to be expected from the equipment models prior to their construction.
5. Equipment layout and design work proceeded concurrently with the construction, investigation and test of the bench models. Models for delivery are now under construction.

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6. The problem of providing a suitable irdome for the equipment could not be solved without prior development of a technique to produce domes of proper material and having well-defined optical quantities. The contractor in cooperation with the Bureau has undertaken the task of guiding an irdome development program on a subcontract basis as an amendment to the contract.

7. After the equipment is in the field, certain special items of optical and electronic apparatus will be required for re-alignment and adjustment. In anticipation of this requirement, this apparatus is being provided as additional items on the contract.

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SECTION B - GENERAL FACTUAL DATA -

PARTICIPATING ENGINEERS

Special Devices Section -

A. H. Kettler	Manager
I. N. Brown .	Manager, Infrared and Associated Equip. Group
A. P. Griffiths	Manager, Mechanical Design Group
P. K. Taylor.	Physicist
W. E. Newman.	Project Coordinator-mechanical
J. W. Woestman	Project Coordinator-electrical
A. D. Davies	Mechanical Engineer
C. Dudziak	Electrical Engineer
M. Malone	Mechanical Engineer
W. E. Martin	Electrical Engineer
J. F. McCoy	Electrical Engineer
W. H. Poucel	Electrical Engineer
H. Singer	Mechanical Engineer
R. E. Sutton	Editor - Handbooks
J. E. Copestakes	Editor - Reports

Advanced Development Section -

G. L. Dimmick	Manager
D. J. Parker	(optics) Physicist
L. T. Sachtleben	Physicist

The personnel listed above have actively contributed to the project during this period but have not necessarily devoted the major portion of their time to it.

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SECTION C - DETAIL FACTUAL DATA -

1. General Summary of Progress - January -

a. Adjustments and repairs were continued during the month to the first AN/AAR-4 equipment which is currently undergoing type tests. Some of the type tests were repeated to verify equipment conformance to specifications.

b. Assembly of all units of the AN/AAR-5 is underway. Wiring of all units has been started with the exception of the scanner.

c. Design work continued on the test equipment. The designs are practically complete. The drawings of the target simulator (for the AN/AAR-4) have been released for parts fabrication.

d. Alignment of additional optical systems was resumed.

2. Completion Dates -

The current delay of the project behind schedule is due to many factors inherent in a developmental project of this magnitude. Every reasonable effort is being made to accelerate delivery without jeopardizing the performance of the equipments. The completion dates given in this report are believed to be realistic, although they are subject to lengthening delivery cycles on items using critical materials and to possible type test ramification. Delivery of the AN/AAR-4 equipments is contingent at the present time upon completion of type tests, and the receipt of the remaining optical mirrors and iridomes.

3. Conferences -

On 18 February a meeting was held at the contractor's plant with representatives of NADC, Johnsville, and the Bureau of Aeronautics, Washington. The subjects of discussion were the type tests being conducted on the AN/AAR-4

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equipment, the financial status of the project, and the progress being made on construction of the equipments and test gear.

4. AN/AAR-4 -

a. Optics -

Alignment of the optical system for the fourth equipment was continued during the month. Work on this phase of the project had been delayed pending the completion of another set of mirrors. Additional sets of mirrors are expected from the vendor during March, and the alignment work can be continued.

b. Models -

Assembly and wiring of the first three equipments is completed. Modifications, which became necessary as a result of the type tests, will be made prior to delivery.

During the month the cold temperature, high altitude, and the humidity cycling tests were repeated twice on the equipments. Arc-over at the tube socket terminals of one of the rectifiers occurred during both the altitude tests in spite of efforts to prevent such an occurrence. The arc-over occurred at the tube pins after the socket was replaced by a different type and the test was repeated. During the humidity tests the high voltage bleeder string in the power supply for the cathode ray tube of the Indicator unit developed leakage paths which caused faulty operation of the display circuitry. Electrical and mechanical design modifications are being made to correct both.

In addition to the above tests, the vibration test of the scanner was repeated. A bearing block shook loose after about ten minutes operation and the test was stopped. This test will be repeated new means having

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been provided for fastening the block. Vibration tests of the Sweep Amplifier and Receiver Control units are also scheduled to be repeated, as stated in the January report.

5. AN/AAR-5 -

a. Optics -

Sufficient mirrors are on hand to complete the first lot of AN/AAR-5 scanners. Delivery of mirrors for the second lot of equipments is being expedited. The contractor has been conferring with the vendor of irdomes in an effort to ease a construction problem and to expedite delivery.

b. Models -

Wiring of the units has been continued. Major units of the first equipment except the Power Supply-Tracker and the Scanner-Detector have been assembled and wired. Systems tests of some of these completed units have been made.

Additional detecting cells for the equipment have been received and are being tested for compliance with the purchase specifications.

Design of a vibration mount for the Scanner-Detector is nearly complete. This vibration mount was considered necessary as a result of experience with preliminary vibration tests of the engineering model.

6. Test Equipments -

a. Mechanical design and layout of the optical alignment set and target simulator hood have been completed. Parts release for fabrication of the target simulator hoods for the AN/AAR-4 have been made. Electrical parts for these hoods are on order.

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b. Circuit development of the target signal generator is practically complete. Mechanical design and layout have been started.

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PART TWO

Program for March -

1. AN/AAR-4 -

- a. Type tests of the first equipment will be continued.
- b. Systems checks, together with final adjustments and modifications as indicated by the type tests will be started on the first three equipments after type tests are completed.
- c. Optical alignment and dynamic balancing of scanner rotor assemblies will be continued.

2. AN/AAR-5 -

- a. Assembly and wiring of units will be continued.
- b. Accumulation of handbook data and revision of manufacturing drawings will be continued.
- c. Alignment of the optical mirrors for the first equipment will be started pending the receipt of the scanner from the subcontractor.
- d. The design of a vibration mounting for the scanner will be completed.

3. Test Equipment -

- a. Accumulation of parts for the target simulator hoods will be continued.
- b. Drafting layouts will be continued for the test signal generator.

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